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A Third Neotenic Salamander of the Genus Eurycea From Texas

By HOBART M. SMITH AND FLOYD E. POTTER, JR.

The caves and streams of the eroded eastern edge of the Edwards Plateau of central Texas are known to be inhabited by a surprisingly large number of endemic species of neotenic salamanders. Three *(Typhlomolge rathbuni, Eurycca nana, Eurycea neotenes)* have been recorded in the past and another is added herewith. We consider it likely that still others are to be found in the same general area.

The first report of this species, so far as we are aware, is in Wright and Wright's "Amphibians of Texas" (Proc. Texas Acad. Sci. 21:31, 1938), where it is stated that "one specimen is reported from a cave near Boerne (R. D. and Ellen Quillan)." In S. C. Bishop's "Handbook of Salamanders" (1943:441), several are said to have been obtained by C. E. Mohr "in a shallow pool deep within the recesses" of Cascade Cavern. Mr. A. J. Kirn has taken specimens from the same locality and still others are present in the collection of St. Mary's University at San Antonio, Texas.

Independent of these sources, the junior author learned of Cascade Cavern and secured several specimens which were exhibited alive on May 12, 1946, at the annual field meet of the Texas Herpetological Society in San Marcos. Observations made at that time and later upon Mr. Kirn's two specimens led to the conclusion that more careful comparisons with *Eurycea neotenes* were warranted. The junior author agreed to secure further specimens for the study and by diligent and repeated effort obtained a total of 19 specimens from the cave; in addition he also obtained several fine series representing related species.

Comparisons of both formalin-preserved and cleared specimens have conclusively demonstrated that those from Cascade Cavern represent a species entirely distinct from the others now recognized. We suggest for it the name

*Eurycea latitans** sp. nov.

Cavern Neotene

Holotype. An adult male, U. S. Nat. Mus. No. 123594, taken from the first large pool deep within the recesses of Cascade Cavern, 4.6 miles by road (3½ miles airline) southeast of Boerne, Kendall County, Texas; collected by Floyd E. Potter, Jr., on May 15, 1946. *Paratypes.* Eighteen, all topotypes, Numbers A338-A340, A-345-A356, collection of Floyd E. Potter, Jr., collected April 4 and May 10, 1946; Texas Co-operative Wildlife Collection Numbers 1195-1197, May 15, 1946; and Numbers 3024-3026, collection of Bryce C. Brown, all collected by Floyd E. Potter, Jr. *Hypoparatypes.* Two specimens (G2, G14, now in the collection of Hobart M. Smith) stained with alizarin red and cleared in glycerin; these were collected by Bryce C. Brown and Robert Singleton at the type locality on May 18, 1946.

Diagnosis. The largest of the neotenic euryceas, reaching a total length of 105.5 mm. and a snout-vent length of 52.5 mm . Similar to *Eurycea nana* and *Eurycea neotenes* (as opposed to *Eurycea tynerensis)* in having a reduced number of costal grooves. It is distinctive in the combination of having usually 15 (14-15) costal grooves; usually only 4 (3-5) costal grooves between the adpressed limbs; a small eye, the diameter of which (lidded part only) enters 3 to 4 times into the interorbital distance; a light pigmentation with a fairly well defined pattern of pigmentless spots; origin of tail fin long and sloping; 18 premaxillary teeth; 17-18 presacral vertebrae; the ossified basibranchial relatively large, slender, T-shaped the arms 3 or 4 times as long as broad, the whole structure about as large as orbit hyoid arch not calcified; phalangeal formula for fingers 2-3-4-3, for toes 2-3-4-4-3.

Description of holotype. Snout rather abruptly flattened, slightly truncate; rear part of head elevated rather sharply at interorbital region; eyes small, lidless, although a distinct depression about the orbit is evident; greatest diameter of orbit, as visible externally (lidded area), entering 3½ times into interorbital distance and 3 times into snout length; nostrils slightly inferior, separated from each other by a distance equal to length of snout, nearer lip than uppermost point of snout; a conspicuous crease from eye to corner of mouth.

Three gills, well developed, the largest reaching about 2/5 of the distance forward to eye (preserved) when adpressed anteriorly to body, or to a point above the middle of the upper foreleg when both leg and gills are adpressed posteriorly; gills lightly pigmented, lower half of each nearly or quite pigmentless; gular fold deflected forward near middle of body, making an angle of about 50°.

* Latin, *Latito,* to hide, conceal.

Forelegs stout, short, well-developed; fingers 1-2-4-3 in order of increasing length; hind legs slightly larger; toes 1-5-2-4-3 in order of increasing length.

Costal grooves 14, not counting an extra one in either axilla or groin; 4 grooves between adpressed limbs; an accumulation of peculiar, yellowish glandular tissue in groin, along the lateral line of both body and tail, and under the dorsal tail fin; the latter beginning about on a level with the base of the toes as limbs are adpressed posteriorly; tail fin becoming elevated gradually posteriorly.

The coloration of the type is much like that described in the following for a live specimen. The pigmentation is somewhat heavier and in preservative the white flecks have completely disappeared.

Color in life. Back with narrow, stippled reticulations incompletely enclosing light areas that tend to be elongate toward the middle of the back and round toward the sides of the back; said areas, toward middle of back, about width of eye, those on dorsolateral line about 3 times as large, rounded, continuing to tip of tail and onto temporal region; latter areas each with a dead white, exceedingly fine, central dot.

Lateral to the dorsolateral light spots is an area of closer but not darker reticulation, ending in a line (supralateral) halfway between the dorsolateral and lateral lines; on the supralateral line the upper halves of the light areas like those in the dorsolateral zone are present, but the lower halves are absent since at and below that level the sides are practically unpigmented; in the center of each of these supralateral spots is a tiny white fleck; the supralateral and dorsolateral series join on the tail at a point about the length of the hind leg to the rear of the insertion of the latter; another series of white flecks just below level of limbs, between axilla and groin. The white flecks in the lowest row are the largest, those in the dorsolateral row the tiniest, and those in the supralateral row intermediate. Between the supralateral and lateral lines are many very tiny, scattered white dots.

The light areas on the back are very light tan; sides below the supralateral line translucent.

An irregular, feeble reticulation is on head; a dim, short light streak back of eye curves down to front edge of gill slit area; an irregular dark line extends through eye, along side of head, and a short distance to the rear of eye; 2 rows of filaments are on each gill rachis; rachises and filaments reddish; the longest (upper) rachis reaching nearly to eye.

All of tail is pigmented except the even, midventral keel; the pattern coarser above, becoming finer, less distinct and more incomplete toward the midventral line.

Variation. Three females are present among the paratypes. In one, a large adult of 53 mm. snout to vent, collected April 16, the eggs are extremely small. Two smaller females collected May 10 and May 18 possess very large eggs presumably nearly ready to be laid. The males, regardless of date of collection, are rather well marked by the swollen glandular area about the anus. It is noteworthy that this glandular area is

incomplete, failing to surround the anus by a narrow area at the posterior end of the opening.

Measurements of the eye opening as given in the accompanying table express the greatest diameter of the area on the surface of the orbit that is in direct contact with the skin. The impression is given of the presence of lids, although true lids are of course absent as in other larval salamanders. Accordingly this area is called the lidded area. Rather exact measurements of it can be made in most adult specimens, but only less accurate approximations are possible in the young and even in certain adults in which the lidded area blends more or less insensibly with the surrounding area. In all cases the eye measurement is based upon the lidded area. It is noteworthy that little variation occurs in the measurements obtained; that of a very immature specimen matches the same in several adults. The chief effect of the differential growth that obtains in this respect is to minimize the utility of the orbit diameter—interorbital space ratio; the latter is much greater in young than in adults.

Other variations of the paratypes are noted in the accompanying table.

The two stained specimens (G2 and G14) have respectively 11-12, 12-12 prevomerine teeth; 8-9, 11-11 pterygoid teeth; 25-24, 24-24 dentary teeth; 7-?, 10-10 splenial teeth; and 18, 17 presacral vertebrae. In both, the phalangeal formula for the fingers is 2-3-4-3, for the toes 2-3-4-4-3; premaxillary teeth 18; the ribs and corresponding vertebral processes stout. The vertebra preceding the sacrum has the rib and centrum fused as one solid piece on one side, while on the other the vertebrarterial canal is present although the four rib and vertebral processes are fused; in the other specimen the tuberculum and diapophysis are fused on one side, while on the other the latter is very long, the former very short; except as specified the ribs are normal and articulate with the vertebrae in the normal fashion. The ossified basibranchial measures about 0.735 mm. in length, 1.33 mm. in width. No portion of Arch 2 (hyoid) of the hyobranchial apparatus is either ossified or calcified.

Comparisons. This species is most readily distinguished from other neotenic species of *Eurycea* by the small size of the eye, which in all specimens measuring more than 34.5 mm. snout to vent is no more than 1/3 the interorbital distance. In *Eurycea nana* and *Eurycea neotenes* the interorbital distance is only about 1 to 1½ times the eye diameter. The reduced number of costal grooves (3-5) between adpressed limbs will separate most specimens from *Eurycea neotenes* (5-7 grooves) and all from *Eurycea nana* (6-7 grooves). Likewise, the average number of costal grooves is distinctive. The number of maxillary teeth (18) is certainly different from that of *Eurycea nana* (7-13) and probably also from that of *Eurycea neotenes.* The shape of the rib processes and of the ossified basibranchial are likewise much different from those of *Eurycea nana* (uncertain for *Eurycea neotenes);* in *Eurycea nana* the rib processes are very slender and the basibranchial is very small and not or scarcely branched.

It is conceivable that the reduction of the eye may be a reflection only of the environment and not of any genetic differences. Experimental work can be expected to throw light upon this question. In any event, there are ample differences from other species in other respects to justify belief that these specimens represent a distinct species.

The very peculiar shape of the head—the flattening of the snout and abrupt elevation at the eye level—is worthy of special attention. The condition is intermediate between that of the larval forms of other euryceas (including *Eurycea nana* and *Eurycea neotenes*), which exhibit no such flattening, and that of *Typhlomolge*, in which the snout is greatly flattened and shovel-like. Whether this may be construed as parallelism or an indication of relationship of these two genera is not apparent.

Table of Variation in *Eurycea latitans*[1]

Number	Sex	Length Snout-Vent[2]	Length Tail	Length Total	Eye Diameter[3]	Interorbital Width	Grooves Between Adpressed Limps	Costal Grooves[4]
3024	F	45.0	44.5	89.5	0.8	3.5	5-5	15
A346	F	45.5	38.0	83.5	0.7	4.0	4-5	15
A338	F	53.0	52.5	105.5	1.2	4.3	5-5	15
A352	yg	21.5	15.5	37.0	0.8	1.5	3-?	15
A350	M	34.5	29.5	64.0	0.7	3.2	3-4	15
A347	M	38.0	29.0	67.0	0.7	3.6	3-4	14
A349	M	40.0	34.5	74.5	0.8	3.3	3-4	14
1195	M	40.0	37.0	77.0	0.9	3.3	4-4	15
3025	M	42.0	40.0	82.0	1.0	3.0	5-4	15
3026	M	42.0	40.0	82.0	0.7	3.5	4-4	15
A348	M	42.0	39.0	81.0	0.7	3.5	4-5	15
A351	M	42.3	43.0	85.3	1.0(?)	3.6	4-4	14
1196	M	43.0	39.0	82.0	0.7	3.5	4-4	15
G14	M	43.5	44.0	87.5	.. ..	.. ..	4-4	14
A345	M	44.5	43.0	87.5	0.7	3.4	4-5	15
A340	M	45.5	43.0	88.5	1.0	3.8	.. ..	15
1197	M	46.0	42.5	88.5	1.0	3.6	3-3	15
U.S.N.M. 123594	M	47.0	50.0	97.0	1.0	4.0	4-4	15
A356	M	47.0	48.5	95.5	0.8	4.0	5-?	15
A339	M	47.5	44.0	91.5	0.9	3.6	4-4	15
G2	M	47.5	49.5	97.0	.. ..	.. ..	4-4	15

[1]Measurements in millimeters.

[2]Measured to posterior portion of vent.

[3]Maximum lidded diameter (see description in text).

[4]Counting no more than 1 extra, either at axilla or at groin.

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Notes on Central American Leiolopisma

By HOBART M. SMITH

In 1940 Stuart (Occ. Papers Mus. Zool. Univ. Mich., No. 421: 2) proposed that *L. assatum* and *L. cherriei* are forms of but a single species, to which the name *assatum* is applicable. In describing *L. cherriei stuarti* a year later, Smith (Proc. Biol. Soc. Wash., 54:181) obviously was not following Stuart's proposal, but no comment to account for this course was given. The reasons were, actually, as follows.

According to Stuart, intergradation between *assatum* and *cherriei* is indicated by two specimens, one from San José del Sacaré, El Salvador, and one from Matagalpa, Nicaragua. The former he described as having the banded tail pattern and reduced dorsal scale count of *cherriei,* "but the adpressed limbs overlap so slightly that it might well be considered intermediate, in this character, between *cherriei* and *assatum.*" In the specimen from Nicaragua "the legs are shortened as in *assatum,* but the number of dorsal scales is typical of *cherriei.*" A specimen similar to this is U. S. Nat. Mus. No. 30604, from "Costa Rica." This has short legs which apparently (stiff and broken) fail to meet by several scales; only 62 dorsals; no (or very indistinct) spotting on sides of neck below the lateral dark stripe, which is confined to the upper part of the sides of the neck; and possibly (all of tail except base missing) a lateral caudal dark stripe (not definite).

The specimens available cannot be held as conclusively showing whether intergradation between *cherriei* and *assatum* series occurs. Against the idea of intergradation are: (1) no species with a pink tail (as in the *assatum* series, including *assatum, taylori,* and *incertum*) is known to intergrade with a blue-tailed species (as in the *cherriei, ixbaac* and *stuarti series);* (2) in extreme southern Oaxaca (and at another point in adjacent Chiapas) the two species are certainly distinct at localities but a few miles apart, and their ranges very probably overlap or dovetail; (3) at least two of the possible intergrades can also be interpreted as belonging to *assatum,* and representing an unnamed southern race; or (4) all the "intergrades" can be regarded as *cherriei* with extremely short legs.

There are arguments against each of these: (1) there is no proof that pink-tailed and blue-tailed species cannot intergrade; (2) northern races of a single species frequently have overlapping ranges, while intergradation is accomplished by connecting southern races; (3) if two distinct species occur in Costa Rica and Nicaragua, they should be better known and should have largely distinctive ranges as elsewhere; as it is, *cherriei* is known from both coasts; and (4) if the three doubtful specimens merely represent extreme variants of *cherriei,* then their apparently uniform geographical provenance is to be explained.

No very satisfactory or final conclusion can be made regarding the identity of the lower Central American specimens until much more material, particularly with observations on the tail color in life, are available. Until such material is available, however, I prefer to hold the three presumed intergrades as members of the species *cherriei*... Regarding the tail character, two give no positive evidence whatever (faded or missing), while the other is like *cherriei*... Two have the combined fore- and hind leg measurements either equal to or very slightly greater than the axilla-groin measurement, but in five other specimens (from Guatemala, Honduras, Costa Rice and Nicaragua) the limb measurements little exceed that between axilla and groin (31-30, 28-27, 26-25, 20-19, 17-16). The last specimen is quite small, (31 mm. snout to vent), and, according to Stuart's theory *(op. cit.)* that leg length is inversely proportional to the size, it may be assumed that at a larger size its legs would not have overlapped; its tail is banded. The only evidence one could possibly consider contrary to the assumption that all the specimens in question are *cherriei* is the extremely small leg proportion (33mm. total leg measurement, 35 mm. axilla ot groin) in the Matagalpa specimen. It is to be observed in this connection that the limbs of northern *stuarti* frequently are shorter than in typical *cherriei* as represented by the Guatemala specimens. A very feasible inference is that the limbs become progressively shorter in any direction away from central Guatemala, which may well include the most primitive population of the species.

However, as before stated, no solution can be entirely satisfactory at present; nevertheless there seem to be fewer facts or indications contrary to this than to any other. I therefore regard the American *Leiolopisma* of this group as follows:

L. assatum assatum (Cope)
L. assatum taylori (Oliver)
L. incertum Stuart
L. cherriei cherriei (Cope)
L. cherriei ixbaac Stuart
L. cherriei stuarti Smith

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Food of *Farancia abacura* in Texas

By D. HOMER BUCK

On May 2, 1946, the writer collected a 29-inch *Farancia abacura reinwardtii* in the soft mud under a "beached" skiff at Normangee Lake, Leon county, Texas. The specimen contained a partly digested *Siren intermedia nettingi* in the stomach. The anterior region of the amphibian was partially digested, but the remains measured 10.5 inches, and the body was 1 inch in diameter, indicating an original length in excess of 11 inches.

Others have recorded that, to the east of Texas, the snake feeds upon fishes, frogs, tapoles, *Amphiuma and Siren lacertina*... Although it is to be expected that *S. i. nettingi* would probably form a part of the diet, I know of no actual record other than the present.

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Captive Specimens of Tropidoclonion lineatum

By L. W. RAMSEY

Last November I captured from a neighbor's flower bed an excellent female specimen of *Tropidoclonion lineatum* Hallowell that was slightly more than a foot long. She lived through the winter underneath a bed of peat moss that had been placed in her cage. Male specimens were provided in the spring as soon as they could be collected and, although no mating was observed, one might have occurred. However, by mid April the specimen appeared to be pregnant. She had a voracious appetite and was usually fed all of the earthworms that she would eat. A few days before August 1 her appetite lessened, and from about Aug. 1 to Aug. 14 she refused to eat. She gave birth to a litter of four on Aug. 14, probably about 3:00 A.M. The delivery was not observed. The weight of the litter was 4.15 grams, or an average of slightly more than one gram per snake. The entire litter refused to eat the small earthworms that were offered and they were turned loose when a week old. The mother began eating again, consuming two medium sized worms the day the litter arrived. She shed for the fourth time this year on Aug. 27.

An adult male specimen had been kept in her cage since March 6, and on Sept. 1 the two were observed in copulation, about 10 o'clock in the morning. The left hemipenis of the male was inserted into the cloaca of the female, whose body in that immediate region appeared to be slightly distended. They were quiet, lying under one of the shelters that had been placed in the cage. They were observed at intervals during the day and remained together until shortly before 4:30 P.M. They were found separated at 4:30 P.M., and had evidently just separated. Unfortunately, no courtship procedure was observed.

Another female of about the same size as the one discussed above was captured May 27. She was obviously pregnant at the time of capture and possessed a bad disposition. When threatened with capture she flattened her entire body, including part of her tail, and spread her head, coiled, and struck at me. She actually struck a small stick that was thrust in front of her. As a captive, she refused all food until Aug. 15, when she was released from captivity. She gave birth to a litter of nine on Aug. 14, all alive. The last one born, however, was almost dead and did not succeed in escaping from the sac in which it was born. Two others, apparently runts, died during the day. The remaining six were larger, quite lively, and five of them shed their skins soon after birth. The other one had not completely shed at the time the lot was released. They refused to eat and were freed the day after they were born. They appeared quite normal, despite the fact that their mother had eaten nothing for over two and a half months. The litter weighed 4.08 grams, or an average of 0.45 gram per snake. For comparison, a juvenile specimen dug from moist earth on Dec. 28 weighed 0.75 gram on Feb. 23 and another, collected March 29, was somewhat smaller.

COLLEGE STATION, TEXAS

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"LACERTA NIEWS"

J. Th. ter Horst, Vier Heemskinderenstraat 159, The Hague, Holland, Editor.

The September issue, No. 9 of the fourth year of publication contains the following interesting articles:

J. H. Kouwenhoven. The spotted salamander; breathing, skin glands, senses, reproduction and hibernation.

D. P. van Wijk. 400 *Anguis fragilis* found in a single spot in August.

J. Th. ter Horst. Describes a vivarium for *A. fragilis*.

J. Smith Jr. Describes a vivarium with sliding panes.

G. Uiterdijik. Color changes in reptiles.

J. Th. ter Horst. Successful importation of reptiles from Surinam by plane.

J. Tuinstra. Discussion of Jean Rostand's book, "Toads and Toad Life."

Charter Members of the Herpetologists League

The following list of Charter Members of the League may serve as a round robin introduction. New Members and all changes will appear in subseqeuent issues.

It is suggested that PRIORITY be given to our Members when distributing separates published in other journals.

An "*" before a Member's name indicates that he has been chosen as a Fellow of the League. The list of Fellows will be added to as information becomes available.

Over 50 museums, libraries, clubs, zoos and several "exchanges" are on our mailing list.

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We would like to have the addresses of the following Members whose subscriptions are still in force.

V. A. Lyman; W. Eugene Saunders; Arthur W. Smith; Roy Naidl; Wm. Lewellyn; Jack Schmaus; Geo. B. Wilmott.

PLEASE STUDY the list of Members in this issue and send us the names and addresses of any persons or organizations that you believe should be on the list, but through inadvertence are not. You will help both the new Member and the League.

Carrion Eating by a Snake

By RAYMOND B. COWLES

Contrary to a rather general belief, individual snakes of many species, require neither moving nor living food material. This fact has been demonstrated repeatedly, but chiefly by means of captive animals. Consumption of carrion by the Squamata, especially snakes, is so rarely noted as to deserve published mention. Furthermore, the behavior of confined animals so often differs from that of free individuals of the same species as to accentuate the necessity of reports based on field observations. This is well-illustrated by the catholicity of taste displayed by captive desert tortoises.

On the morning of May 5th, 1946, at Cottonwood Springs, Riverside County, California, a red racer, *Coluber flagellum piceus* was observed eating the badly decomposeed carcass of a poorwill, probably *Phaelaenoptilus nuttali*... The bird was so highly odorus that after a casual examination it had been tossed into a nearby bush where it lodged in the uppermost twigs 41 inches from the ground. The snake was still partly stretched on the ground when it was observed swallowing the anterior part of the poorwill high overhead.

It was impossible to determine the sensory organs that had been employed in detecting the bird. A slight breeze occasionally ruffled the plumage and also the scanty foliage of the bush. The snake had approached from down-wind which suggests that the odor might have led it to the general vicinity of the bush.

From my own observations on snakes, I would least expect this active, reptile-eating species of racer to resort to carrion, even though such behavior might be less surprising in slower moving forms.

UNIVERSITY OF CALIFORNIA, LOS ANGELES

Snake Devours Its Own Slough

By ROBERT H. MATTLIN

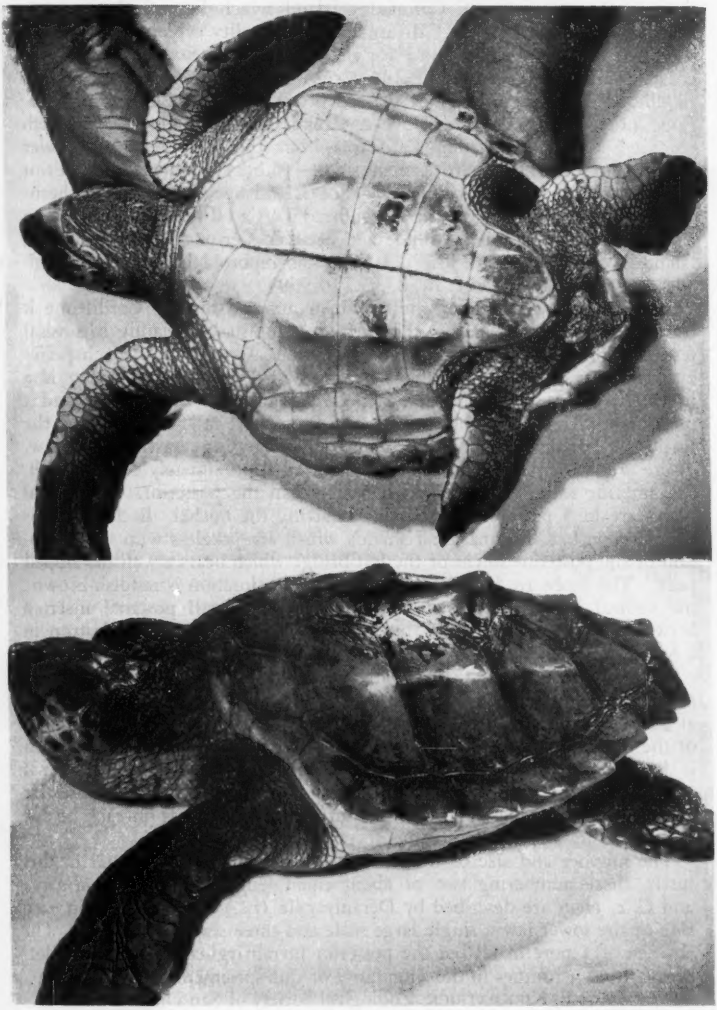
I was feeding the snakes in the collection of the Cleveland Zoological park on the evening of September 20, 1946. A mouse was introduced into a cage containing three blue racers, *Coluber c. flaviventris*. Two of the snakes immediately began to pursue the mouse. In the confusion that ensued, the smaller of the two, a male 93 cm. long with a portion of the tail missing, grasped the slough it had shed a few hours previously and proceeded to engulf it greedily. I summoned Mr. E. F. Kiefer of the Zoo staff and we both watched until the skin was completely ingested.

Racers are to some extent cannibalistic. This might account for the fact that the snake did not try to rid itself of the slough which it had grasped. The swallowing took about twelve minutes.

CLEVELAND ZOOLOGICAL PARK, OHIO

An Anomalous Pacific Loggerhead Turtle from the Northwestern Coast of Baja California

By CHARLES E. SHAW



UPPER: Note pore at tip of keel on posterior inframarginal of left bridge and the two enlarged mandibular scutes.
LOWER: Showing prominent keeling of costals and vertebrals.

Recently, Mr. N. F. Cordileone presented to the Zoological Society of San Diego a specimen of the Pacific Loggerhead Turtle *(Lepidochelys olivacea olivacea)* he had captured at sea during the first week in August, 1946. The turtle was taken at about latitude 32° some 25 to 30 miles west southwest of North Coronados Island which lies off the extreme northwestern coast of Baja California. This locality evidently constitutes the most exact northerly record for the Pacific Loggerhead Turtle in the coastal waters of the eastern Pacific Ocean and definitely strengthens the likelihood of the occurrence of the subspecies off the coast of California. Pope (1939, Turtles of the U. S. & Canada, p. 287) remarks:: Strauch recorded a specimen from 'California,' but this may refer to Lower California, for which there is at least one (other) good record." Prior to the capture of the North Coronados Island specimen, the northernmost points of collection of the Loggerhead Turtle off the Baja Californian coast have been "at sea at latitude 22° between Cerros and San Benedicto Islands," and "near San Jose del Cabo" as reported by Van Denburgh (1922, Occas. Papers Calif. Acad. Sci., 10:999).

In attempting to identify the specimen donated by Mr. Cordileone it became at once apparent that this turtle was unusual, deviating in several respects from the normal limits of variation ascribed to the subspecies by Deraniyagalà (1943, Spolia Zeylanica, 23:87). The specimen is a juvenile with a straight-length carapace measurement of 9 inches and a plastron length of 8 inches. The extremely short tail indicates that the turtle is a female. There is a prominent alveolar ridge on the upper jaw. There are two enlarged mandibular scales of approximately equal length, the anterior scale being somewhat wider than the posterior. The costal plates are in 5 pairs, the first pair contacting the nuchal. Each bridge is provided with 4 inframarginal shields which are poreless with the exception of the posterior shield of the left bridge which bears a well developed pore. The limbs are two-clawed. The dorsal coloration is reddish-brown; the ventral coloration is yellowish. There is a small postanal inserted between the posterior tips of the anal plates, terminating the plastron in a rounded tip.

In some respects the turtle seems to be intermediate between *Lepidochelys o. olivacea* and *Caretta c. gigas* as defined *by Deraniyagala* (l.c.) at least in external characteristics. An examination of the configuration of the neural and costal bones cannot be made at this time as the specimen is being retained for display at the Zoo. The reddish-brown dorsal coloration is that of *C. c. gigas* while the presence of an obvious alveolar ridge on the upper jaw and the four inframarginal shields on each bridge are characters which allocate the specimen to *L. o. olivacea.*

The number and size of the mandibular scales are also peculiar in this turtle, these numbering two of about equal length while *L. o. olivacea* and *C. c. gigas* are described by Deraniyagala (l.c.) as possessing on each side of the lower jaw a single large scale and three scales respectively. The absence of a pore in all but the posterior inframarginal shield of the left bridge further testifies to the singularity of this specimen.

Photos by G. E. KIRKPATRICK, Zoological Society of San Diego.

ZOOLOGICAL SOCIETY, SAN DIEGO, CALIFORNIA

The Stump-Toed Gecko, Peropus mutilatus Introduced Into the San Diego California Area

By CHARLES E. SHAW

The writer was stationed at the Navy Yard, Pearl Harbor, Oahu, throughout 1944 and until early November, 1945. During this period occasional shipments of gecko eggs were sent via air mail to Mr. C. B. Perkins at the reptile house of the San Diego Zoo. The eggs were of the four species occurring on the island, *Lepidodactylus lugubris, Peropus mutilatus, Hemidactylus garnotii* and *Hermiphyllodactylus typhus.* The intent was to establish a continuous supply of food in the warm environment of the reptile house for the lizard-eating snakes. The Hawaiian geckos were thought to be ideally suited to this purpose because of their apparently year-round breeding activities which would assure an abundant source of material for feeding purposes.

Mr. Perkins informs me that nearly all the eggs sent to him hatched and that the young were freed in the reptile house. The Stump-toed gecko, *Peropus mutilatus* has apparently been the only species to persist. It is relatively common in the building now.

In early May, 1946, while hunting for termites beneath the bark of a fallen eucalyptus tree in the Zoo grounds I was surprised to find a very large specimen of *P. mutilatus* which I was unable to capture. The log is about 200 yards west of the reptile house and across a steep canyon. Many other geckos may have escaped through ventilators, cracks under the doors and similar openings of the reptile house.

It is not yet definitely known whether this species will survive a winter and eventually become established in the park areas surrounding the Zoo and thence to other parts of the city and county. I believe that the cooler winter weather will merely prevent incubation for a part of the year. The warm spring and summer should allow a sufficient number of eggs to hatch to perpetuate a feral population of this valuable insect-eating nocturnal lizard.

ZOOLOGICAL SOCIETY OF SAN DIEGO, CALIF.

DESIDERATA

Unusual or Puzzling Specimens of *Natrix* are desired by Mr. Roger Conant, Phila Zool. Garden Phila. 4, Pa. Mr. Conant is gradually monographing the group. Intermediate specimens are particularly valuable to him. Please contact.

DESIDERATA

Mr. Ross Allen, Silver Springs, Fla., is working on the habits of *Akistrodon piscivorous* and would appreciate observations.

Observations on the Feeding Process in *Plethodontidae*

By MRS. ROBERT BRANDT

When a few weeks ago I was given a Cave Salamander *(Eurycea lucifuga)* to add to my small reptile and salamander collection, I was faced with quite a feeding problem. Earthworms, mealworms, flies and ants did not arouse the cave salamander's appetite. Small pieces of raw meat, the usual food for the rest of my salamanders *(Ambystoma t. tigrinum, Ambystoma texanum, Triturus v. viridescens* and *Triturus v. dorsalis)* were not recognized by Eurycea.

Finally I put in a few small soft-bodied roaches in the terrarium. The cave salamander became alert, and it started to eat in a manner I thought at that time unusual in a salamander. Its slender tongue shot out about an inch long, and the bug disappeared. Since, the cave salamander has been eating regularly in this fashion, consuming four to seven bugs a day.

I tried to find some literature to read about this method of feeding, but only one German book mentioned the fact, that the European Brown Salamander shoots the tongue out to catch his prey.

Some days ago, the naturalist, Karl H. Maslowsky gave me a few salamanders which he had caught on one of his recent trips. Among them were *Eurycea b. bislineata, Eurycea l. longicauda, Plethodon g. glutinosus, Plethodon c. cinereus* and *Desmognathus f fuscus.*

Though all of them are members of the Family Plethodontidae, only *Eurycea bislineata, Eurycea longicauda* and *Plethodon glutinosus* shoot their tongues out to catch a passing bug.

The red-backed Salamander, *Plethodon cinereus,* a very small specimen, shows a preference for bugs, also a very small specimen of the dusky Salamander, *Desmognathus fuscus,* is feeding on bugs. The larger dusky salamanders (2 to 5 inches long) feed on earthworms and mealworms.

CINCINNATI, OHIO

THE NATURALISTS' DIRECTORY

Mr. Herman E. Cassino, Editor of the Naturalists' Directory, Salem, Mass., has cooperatively included HERPETOLOGICA among the 136 periodicals listed in the 34th, 1946 issue. We urge any of our Members who are not included, to communicate with Mr. Cassino so that their names will appear in the next issue. Inclusion in the Directory appears to be as desirable as registering at a scientific meeting.

Dr. Clement Samuel Brimley

By HARRY T. DAVIS

DR. CLEMENT SAMUEL BRIMLEY

Dr. Clement Samuel Brimley was born at Great Linford, England on December 18, 1863. He passed away at Raleigh, North Carolina on July 23, 1946.

Dr. Brimley was primarily an entomologist and ornithologist, but as his herpetological bibliography shows, he contributed significantly to the study thereof. He arrived from England with his parents in 1880 and with his brother, H. H. Brimley, devoted their lives to natural history.

About 1881 these brothers began collecting natural history specimens in what was an unworked field. Their basic text was a small book "Taxidermy Without a Teacher." H. H. Brimley went into building a State Museum in 1884 and C. S. Brimley continued the supply business. With scant formal education, the latter was primarily a task of laborous research in biology. He built his own keys and made his identifications the hard way. In 1919 he joined the Entomology Division of the N. C. Department of Agriculture and scientific workers were already beating a path to his door. He was contributing many original scientific articles in the whole field of zoology that brought him recognition and admiration. Additional recognition came when the faculty of the University of North Carolina petitioned in 1938 that he be awarded an honorary doctorate. This was done at the June Commencement. In 1930 the U. S. Biological Survey awarded him a 46 year Certificate for bird migration studies. He was founder of the N. C. Academy of Sciences, the Raleigh Natural History Club and member of many scientific organizations.

Herpetological Titles of Dr. C. M. Brimley

Notes on reptiles., Nat. Sci. News., Vol. 1., p. 71, 1895. List of snakes observed at Raleigh, N. C., Amer. Nat. Vol. 29, pp. 56-57, 1895.

Habits of *Heterodon platyrhinus* at Raleigh, N. C. Amer. Nat. 29: 75. 1895.

Batrachia found at Raleigh, N. C. Amer. Nat. 30: 500-501. 1896.

Notes on the reproduction of certain reptiles. Amer. Nat. 37: 261-266. 1903.

Box tortoises of southeastern North America. J. E. M. Sci. Soc. 20: 27-34. 1904.

A case of snake-bite by the victim. J. E. M. Sci. Soc. 20: 137. 1904.

Further notes on the reproduction of reptiles. J. E. M. Sci. Soc. 20: 137-140. 1904.

Notes on the scutellation of the red king snake *(Ophiobolus doliatus coccineus)*. J. E. M. Sci. Soc. 21: 145-148. 1905.

Notes on the food and feeding habits of some American reptiles. J. E. M. Sci. Soc. 21: 149-155. 1905.

Artificial key to the species of snakes and lizards which are found in North Carolina. J. E. M. Sci. Soc. 23: 142-149. 1907.

The salamanders of North Carolina. J. E. M. Sci. Soc. 23: 150-156. 1907.

A key to the species of frogs and toads liable to occur in North Carolina. J .E. M. Sci. Soc. 23: 157-160. 1907.
Notes on some turtles of the genus *Pseudemys*. J. E. M. Sci. Soc. 24: 76-84. 1907.
Some notes on the zoology of Lake Ellis, North Carolina, with special reference to herpetology. Proc. Biol. Soc. Wash. 22: 129-138. 1909.
Records of some reptiles and batrachians from the southeastern United States. Proc. Biol. Soc. Wash. 23: 9-18. 1910.
Notes on the salamanders of the North Carolina mountains with description of two new forms. Proc. Biol. Soc. Wash. 25: 135-140. 1912. Describes *Plethodon metcalfi* and *Spelerpes ruber schencki*.
List of the reptiles and amphibians of North Carolina. J. E. M. Sci. Soc. 30: 195-206. 1915.
The two Raleigh Amblystomae compared. J. E. M. Sci. Soc| 32: 45. 1916.
Some known changes in the land vertebrate fauna of North Carolina. J. E. Sci. Soc. 32: 176-183. 1917. Notes on mammals, birds, reptiles.
The two forms of red *Spelerpes* occurring at Raleigh, N. C., Proc. Biol. Soc. Wash. 30: 87-88. 1917.
A brief comparison of the herpetological faunas of North Carolina and Virginia. J. E. M. Sci. Soc. 34: 148-149. 1918.
Eliminations from and additions to the North Carolina list of Reptiles and amphibians. J. E. M. Sci. Soc. 34: 150-151. 1918.
Pituophis melanoleucus in North Carolina. Copeia No. 63:92. 1918.
A snake item. Copeia No. 64:97. 1918.
Notes on *Amphiuma* and *Necturus*. Copeia No. 77: 5-7. 1920.
Reproduction of the Marbled salamander. Copeia No. 80:25. 1920.
Notes on *Pseudemys scripta* Schopf, the yellow-bellied terrapin. Copeia No. 87:93-94. 1920.
A partly spotted king snake. Copeia No. 88:100-101. 1920.
Notes on *Lampropeltis elapsoides virginianus*. Copeia No. 89: 106-107. 1920.
The turtles of North Carolina. J. E. M. Sci. Soc. 36:62-71. 1920.
Breeding habits of *Ambystoma maculatum* at Raleigh, N. C. Copeia No. 93: 26-27. 1921.
Life history of the American newt. Copeia No. 94: 31-32. 1921.
Herpetological notes from North Carolina. Copeia No. 107: 47-48. 1922.
Herpetological notes from North Carolina, II. Copeia No. 109: 63-64. 1922.
North Carolina herpetology. Copeia No. 114:3-4. 1923.

The dwarf salamander at Raleigh, N. C. Copeia No. 120: 81-83. 1923.

The copperhead mocassin at Raleight, N. C. Copeia No. 124: 113-116. 1923.

The water dogs *(Necturns)* of North Carolina. J. E. M. Soc. 40: 166-168. 1924.

The seasonal catch of snakes at Raleigh, N. C. J. E. M. Sci. Soc. 41: 100-103. 1925.

Revised key and list of the amphibians and reptiles of North Carolina. J. E. M. Sci. Soc. 42: 75-93. 1926.

Some records of amphibians and reptiles from North Carolina, Copeia No. 162: 10-12. 1927.

Notes on water snakes at Raleigh, N. C. Copeia No. 162: 14-15. 1927.

A specimen of the virginia red king snake with unmarked underparts. Copeia No. 164: 72-73. 1927.

An apparently new salamander *(Plethodon clemsonae)* from South Carolina. Copeia No. 164: 73-75. 1927.

Yellow-cheeked *Desmognathus* from Macon County, N. C. Copeia No. 166: 21-23. 1928.

Two new terrapins of the genus *Pseudemys* from the southern states. J. E. M. Sci. Soc. 44: 66-69. 1928.

The amphibians of N. C., Mimeo. by Forestry Div., N. C. Dept. of Conservation and Development, Nov. 1939.

The reptiles of N. C., same as above.

Amphibians and reptiles of N. C., Carolina Tips., Car. Biol. Supply Co., Elon College, N. C., 64 pp. card-bound book, 1939-1943, no pagination.

————and W. B. Mabee. Reptiles, amphibians and fishes collected in eastern North Carolina in the autumn of 1923. Copeia, pp 14-16. 1925.

———— and Harry T. Davis. Poisonous snakes of the eastern United States, with first aid guide. N. C. State Museum, Raleigh, N. C., pp. 1-16, 1942.

Synopsis of Herpetological Literature in the Proceedings of the Iowa Academy of Science, 1891-1944

By HUGH CLARK

A list of forty-three papers has been compiled below which were published in the Proceedings of the Iowa Academy of Science pertaining in some aspects to herpetology. The papers are listed within each taxonomic group according to author. Notations of content, or where appropriate, abstracts are provided for those which have not been listed in the ZOOLOGICAL RECORD or BIOLOGICAL ABSTRACTS. In some instances omission from these bibliographic sources may have been intentional by the editors, since papers of similar content were presented frequently in more accessible journals. Taxonomic usage and typographical errors in the original titles have been retained. Volume 51 of the Proc. Ia. Acad. Sci. includes a complete zoological index, although cross-indexing is not thorough.

General

Bailey, Reeve M. Four Species New to the Iowa Herpetofauna, with Notes on Their Natural Histories. 50:347-352. 1943.

Ambystoma texanum (Matthes). Small mouthed salamander. It occurs in "southern two rows of Iowa counties . . . and in the eastern portion extends north at least to the vicinity of Iowa City." Localities are listed. Egg clusters, ecological situations and breeding habits are discussed.

Hyla crucifer Wied. Spring Peeper. "Restricted in Iowa to the wooded eastern edge of the state." Locality records are cited, and breeding habits receive comment.

Rana areolata circulosa Rice and Davis. Northern Crayfish Frog. An extension of the previously published range is noted. Locality records are supplied, and breeding habits, habitat, ecological relationships and growth data are presented.

Eumeces obsoletus (Baird and Girard). Sonoran Skink. Two specimens are described from southwestern Iowa. One deposited in captivity a clutch of seven eggs, whose measurements are given.

Ruthven, A. G. Contributions to the Herpetology of Iowa. 17: 198-209. 1910.

————Contributions to the Herpetology of Iowa, II. 19:207. 1912.

Several species of amphibia and reptiles are listed from the collection of Grinnell College or verbally authenticated by Prof. H. W. Norris of that college.

Shimek, B. Holbrook's North American Herpetology. First Edition. 31:427-430. 1924.

A previous discussion of Volume IV of this set is reviewed. Shimek discusses the artists and their contributions and lists the plates of Vol. IV. The specie name of *Desmoq nathus quadramaculata* is examined from the viewpoint of page priority, and brief consideration is given others.

Somes, M. P. Notes on Some Iowa Reptiles. 18:149-154. 1911.

A list of reptiles in Iowa is supplied and keys are provided for the garter snakes and turtles.

Amphibia

Baldwin, Francis M. Pharyngeal Derivatives of Amblystoma. 25:111-116. 1918.

Development, functional maturation and blood supply of the thyroid are reviewed. The carotid gland and epithelian bodies in Amblystoma begin their development at the time of metamorphosis; their structure and location are described.

————. Alcohols as Factors in Altering Fatigue Processes in Frog Muscle, 28: 161-177. 1921.

Effects of varying concentrations of eight alcohols on rate of fatigue development are described.

Drew, Gilman. Some Reasons Why Frogs are Able to Survive. 1 (3): 32-35. 1892.

Survival depends on (1) amphibious habit, (2) tolerance of temperature change, (3) existence for long periods without food, and (4) great productivity. These conclusions are based on experiments described in the paper.

Gilbert, Winifred M. Ambisexuality and Sex Differentiation in Amblystoma 47: 307-327. 1940.

Kuntz, Albert. Notes on Methods for Study of Amphibian Eggs and Larvae. 18: 145-146. 1911.

————. An Instance of Polymely in the Frog. 30:157-161. 1923.

Norris, H. W. The Development of the Auditory Vesicle in Necturus. 1 (4): 105-107. 1893.

Formation of the auditory placode and vesicle are described with figures. Development of these structures is similar to that in other amphibia.

————. The Morphology and Function of the Amphibian Ear. 8:76-78. 1900.

————. The Membrane Bones in the Skull of a Young Amphiuma. 10: 69-74. 1902.

A specimen of 51 mm. was studied and the status at this size of various dermal bones is described.

————. The So-called Dorsotrachealis Branch of the Seventh Cranial Nerve in Amphiuma. 11:95-97. 1903.

This nerve is a branch of the hyomandibular trunk; it runs backward through the digastric, dorsotrachealis and longissimus dorsi muscles and probably continues into the tail. Its functions are uncertain.

————————. The Vagus and Anterior Spinal Nerves in Amphiuma. 11:98-102. 1903.

Eight nerves are given off the IX-X ganglion: Jacobson's commissure, supratemporalis (?), glossopharyngeal, branchial trunk; second branchial nerve, third branchial nerve, ramus lateralis superior of vagus, ramus lateralis medius of vagus, and ramus inferior of vagus. The hypoglossal arises by 4 roots, three of which are rudimentary. The first spinal nerve sends one branch to the vagus and the other toward the thymus gland. The second and third spinal nerves form the brachial plexus. Distribution of these nerves is clarified by a figure.

————————. The Innervation of the Lateral Line System of Amphiuma. 14:273-278. 1907.

The "dorsal seventh" supplies the supraorbital series, the infraorbital series, the postorbital, the jugular, the angular, and the oral series as well as the gular series. The IX-X complex supplies the occipital group, the dorsal trunk series, the middle trunk series and the ventral trunk series.

————————. The Fifth and Seventh Cranial Nerves in Plethodon glutinosus. 16: 189-191. 1909.

Three nerves, ramus mandibularis, r. maxillaris and r. ophthalimicus arise from the Gasserian ganglion. Their distribution and relationships are described.

————————. The Cranial Nerves of *Siren lacertina*. 17:223-226. 1910.

————————. The Rank of Necturus among the Tailed Amphibians as Indicated by the Distribution of its Cranial Nerves. 18: 137-143. 1911.

————————. On Certain Points in the Anatomy of *Siren lacertina*. 20:291-294. 1913.

An osseous nodule opposite the middle of the premaxillaries, sometimes lacking unilaterally or bilaterally, is probably a maxillary bone. The splenial is formed chiefly by fusion of the bases of teeth. Two muscles inserting on the antorbital cartilage are noted, derivatives of the anterior part of the pterygoid muscle They are called levator bulbi and retractor bulbi.

————————. The Eyeball and Associated Structures in the Blindworms. 24:299-300. 1917.

———————— and M. Buckley. The Peripheral Distribution of The Cranial Nerves of *Necturus maculatus*. 18:131-135. 1911

Parker, R. L. The Relative Position of the Maxima Contractions of the Amphibian Muscle When Subjected to Various Ranges in Temperature. 27:311-318. 1920.

Patterson, T. L. The Role of the Vagi on Gastric Motility in *Necturus maculatus*. 30:185-187. 1923.

Stimulation of isolated vagi resulted in diminished gastric motility; vagotomy produced augmented gastric contractions. Place, B. A. Relation of the Motor Nerve Endings to Voluntary Muscle in the Frog. 13:261-266. 1906.

Serpentes

Baldwin, F. M. Oxygen Consumption at 20° in Certain Snakes *Pituophis sayi* and *Lampropeltis getulus holbrooki* with some Notes on Size and Seasonal Difference. 35:313-318. 1928.

In the spring the average oxygen consumption of the bull snake is 0.0583 cc./gm./hr.; the fall average is 0.0580. *Lampropeltis* averaged 0.0806 cc./gm./hr., though there was a wide variation.

Ball, E. D. Snakes "Swallowing" Their Young. 22:343-344. 1915.

Prof. Ball (Cf. Amer. Men of Sci., 7th Ed.) confuses this issue by reported observations of the phenomenon many times, and denies the possibility of optical illusion. The snake observed was a "large and 'motherly' looking specimen of the common garter snake of the region." Signal for the young to enter was a "hissing sound."

Clark, Hugh. The Anatomy and Embryology of the Hemipenis of *Lampropeltis, Diadophis* and *Thamnophis* and their Value as Criteria of Relationship in the Family Colubridae. 51:411-445. 1944.

Evidence is presented which indicates that the primitive hemipenis was split-sulcused and flounced. Apical calyx formation gave origin to the xenodontine ancestral type, apical spine formation gave rise to the lycodontine ancestral type. Colubrine was derived from xenodontine, and natricine from lycodontine, by modification toward singleness.

Guthrie, J. E. The Banana Snake, *Boa imperator*. 30:189-196. 1923.

———. Snake Notes. 31:417-418. 1924.

This is apparently a preliminary report and abstract of the 1929 paper of the same title, q. v.

———. Snake Notes. 36:349-359. 1929.

The author observed many specimens of more than fifty species. A narrative report is presented on snake lore, feeding habits, social habits, internal and external parasites, shedding, replacement of rattles; loss of poison fangs, abundance and bounty payments on rattlesnakes, occurrence of *Virginia elegans* Kennicott in Iowa, incubation period in snakes, measurements of foxsnake eggs and description of them. A series of embryos is figured and instances of bicephaly are figured and discussed.

———. Freak Color Inheritance in Graham's Water Snake. 37:375-377. 1930. (Listed by Zool. Rec. as 32:375-377.

Job, Thesle T. Some new Endoparasites of the Snake. 24:315-317. 1917.

A male *Porocephalus glabicephalus Hett,* a linguatulid, is decribed. Six specimens of a new renifer were collected from the body cavity. No name is provided for the new species. The posterior 10 cm. of the intestine was almost covered with encysted larval *Gigantorhynchus,* an acanthocephalan.

Testudinata

Baldwin, F. M. Notes on Oxygen Consumption in Turtles, *Chrysmus marginata belli* and *Chelydra serpentina Linn.* 33:315-323. 1926..... .....

At 20° C. basal oxygen consumption averaged 0.0261 cc./gm./hr. for painted turtles and 0.0582 for snapping turtles. Caloric measurements were indirect, but were of the same order as those obtained by the direct method of Rubner.

Fritsch, Emery G. Food Habits of the Western Painted Turtle. *Chrysemys marginata bellii* Gray. 47:361-369. 1940.

Goldsmith, William M. Notes on the Egg Laying Habits of the Soft Shell Turtles. 51:447-449. 1944.

Amyda mutica deposits eggs in clean, sandy soil in nests 6 to 9 inches deep. High water forces nesting into unsuitable places, sometimes on the surface of the ground. They were easily frightened during preparation of the nest, but not during actual oviposition. Approximately 19 eggs is the average per clutch. The raccoon is a serious predator of the nests.

Nicholson, F. A. and Paul Risley. A study of the Urogenital systems of Emys blandingii, with observations on occurrence of Mullerian Ducts in Males. 47:343-360. 1940.

Stromsten, Frank A. The Development of the Posterior Lymph Hearts of the Loggerhead Turtle. 17:227-228. 1910.

———————. The Development of Lymph Channels in Turtles by Fusion of Mesenchymal Spaces. 18:147. 1911.

Lymphatics in the turtles are derived from mesenchyme around the aorta and larger arteries by fusion of small independent spaces.

———————. The Development of Musk Glands in the Loggerhead Turtle *(Abstract).* 24:311-313. 1917.

The glands may or may not be present in the loggerhead turtle at hatching. There are two pairs whose structure and developmental pattern are described with figures.

RHYNCHOCEPHALIA

Keck, Warren. Some additional Observations on *Sphenodon punctatum* in captivity. 32:429-430. 1925.

Krull, W. H. Observations on *Sphenodon punstatum* in Captivity. 30:151-155. 1923.

STATE UNIVERSITY OF IOWA, IOWA CITY, IOWA.

Incubation and Respiration of Eggs of Crotaphytus c. collaris (Say)

By HUGH CLARK

A female specimen of *Crotaphytus collaris collaris* was collected May 18, 1946 at Manhattan, Kansas. Total length was 267 mm.; tail length was 165 mm. The specimen was kept alone in a glass and wire-screened cage with clean water before her at all times. She fed regularly on large grasshoppers, *Melanoplus differentialis*. Behavior in captivity was quiet, though she was never amenable to handling.

Eight eggs were found in the cage on June 17; the condition of one of them indicated that it had been laid probably June 15, while the remainder were more likely deposited on June 16. A ninth egg was laid on June 24 and a tenth on June 28. The ninth egg was somewhat shrunken, but the tenth was perfectly formed with the exception that its shell was thinner than those of its fellows.

Incubation

Egg measurements were made, and with a respiratory study in mind, suitable methods of controlled incubation were sought. Some eggs were placed in a 4-gallon glass container on a wire screen over distilled water, thus bathed in an atmosphere of 100% relative humidity; one was placed over a solution of saturated NaCl in the same manner, resting thus in an atmosphere of approximately 75% relative humidity. All were kept at room temperature, which varied between 20° C. and 26° C. Dehydration of the eggs was apparent after the first day, though it had been more rapid in the egg over the salt solution. It was found necessary to keep at least part of the egg in actual contact with a moist surface. To accomplish this a coarse cloth was placed over the wire screen, with its ends dipping into the water to serve as a wick. In the course of these trials at a proper method of incubation, some of the eggs inevitably died. Hence respiratory records for this series of eggs are not complete.

Measurements

Caliper measurements of length and greatest diameter of the eggs were made to the nearest millimeter. Volume was determined by displacement of water in a narrow, 25 cc. graduate. Egg measurements are presented in Table I. Extremes in length were 18.3 mm. No. 7, June 18) and 21.2 mm. (No. 8, June 20); extremes in width were 12.0 mm. (No. 4, June 18) and 14.0 mm. No. 2, June 22). Mean measurements for the three days are presented in Table II.

Table I

Egg Measurements for June 18, 20, 22 in That Order

Egg	Length mm.	Width mm.	Volume cc.
1.	Too shrunken to obtain valid measurements.		
2	19.1	12.9	
	19.6	12.8	
	20.1	14.0	1.0
3.	20.0	13.1	
	20.1	13.0	
	20.1	13.5	1.5
4	20.1	12.0	
	21.0	12.2	
	20.0	12.4	1.4
5	20.4	12.6	
	20.5	13.0	
	20.4	13.0	1.5
6	20.2	12.4	
	20.2	12.4	
	20.0	12.8	1.5
7	18.3	12.0	
	20.0	12.7	
	20.2	13.5	1.1
8	19.8	13.0	
	21.2	12.5	
	20.7	13.6	1.5
9	Shrunken, valid measurements not available		
10	21.0	12.0	1.5 (June 28)

Table II

Mean Measurements Obtained from Table I

Date	Length	Width
6-18	19.86±0.77	12.50±0.44
6-20	20.38±0.53	12.66±0.26
6-22	20.21±0.24	13.26±0.58

A slight initial increase in both length and width is apparent, presumably as a result of water uptake, though the statistical reliability is questionable. The last figures show a slight decline in length and a slight increase in width, which would result in only slight volume change. In these data, a certain degree of elasticity of the shell is attested, as well as the fact that water is taken up rapidly at first, with an extrapolated diminution in rate thereafter.

Status of the Embryo

Eggs No. 1 and No. 9 were opened the day after they were laid, and no recognizable embryo was found in either. On June 22, eggs No. 2 and No. 7 were opened and contained an unidentifiable fragment of embryonic tissue. On June 25, egg No. 8 contained a reticuloform mass of blood vessels (beginning yolk sac) and an embryo in the primitive streak stage. It lay on the bottom of the egg and hence came in direct contact with water. Mold had accumulated on the upper side of the egg. It is believed that, in this and other instances, death of the embryo preceeded death of the vitelline membrane; the resultant increased permeability of the vitelline membrane allowed egress of the yolk and provided a medium for the growth of mold. Thus, the appearance of mold would be a sequel to embryonic death rather than a causative agent. A small amount of white (albumen) was found around the site of the embryo; the albumen is coagulable by heat, like that of precocial birds, as might reasonably be expected.

On June 29, eggs No. 3-5 and No. 10 were examined. Eggs No. 3 and 4, killed by KOH incident to respiratory study, revealed nothing. Eggs No. 5 and 10 each contained an embryonic mass in approximately the same state of development as No. 8 above; the yolk sac had increased noticeably in size. Egg No. 6 was opened July 5, and a small mass of embryonic tissue was identified.

Respiration

Oxygen uptake, carbon dioxide production and respiratory quotient were calculated insofar as material permitted, using a modified Warburg apparatus. Oxygen consumption was determined by absorbing CO^2 with KOH and recording the pressure change thus produced. Carbon dioxide production was determined indirectly as follows. Prior to obtaining data on O^2 uptake, the egg was run without KOH. The change in pressure thus produced was actually oxygen uptake minus carbon dioxide production for the period of observation. When this figure was subtracted from the subsequently obtained oxygen uptake the resultant figure is the amount of carbon dioxide produced. This method assumes that the rate of respiration during the run without KOH (approximately an hour) is the same as that during the run with KOH extending over the same length of time, immediately following. Constant temperature of 26.0° C. was maintained throughout the observation period by means of a water bath thermostatically controlled. All data pertaining to volume of gas utilized or given off are corrected to conditions of standard temperature and pressure. Records are available for four of the eggs, but no sustained series

of readings was possible for any of the eggs. These data are summarized in Table III.

Table III

O_2 Consumption and CO_2 Production (c. mm. 1 hr.) and R. Q.

Date	Egg	O^2	CO^2	R. Q.
6-19	5	95.0	102.0	1.07
6-20	5	74.2	45.7	0.615
6-20	6	90.0	90.0	1.00
6-22	5	51.2	42.9	0.837
6-27	3	73.8	37.8	0.513
6-27	4	80.5	58.2	0.725
Mean		77.5	47.8	0.793

The data represent individual readings. The low R. Q. for 6-20 and 6-27 cannot be adequately explained, though it may be attributed to two factors: loss of CO^2 by the shell since no device was used to circulate the atmosphere around the eggs in the incubation chamber, or oxygen production by enzymatic action in the yolk, (Cf. Needham, P. 698 et seq.). At a comparable stage in development in the chick, Hasselbalch (1900) reported an R. Q. of 0.642. Hasselbalch's readings also showed a considerable range of variation.

Summary

1. A specimen of *Crotaphytus collaris collaris* deposited a clutch of 10 eggs in captivity over the period June 15-June 28, 1946.

2. A method of incubation of the eggs is described, and measurements of the eggs are tabulated.

3. Average oxygen consumption for the period studied is 77.5 mm^3/hr; average CO^2 production is 47.8 mm^3/hr.; average R. Q. is 0.793.

References

Hasselbalch, K. A. Skand. Arch. f. Physiol. 10:353-402. 1900.

Needham, J. Chemical Embryology, Vol. II. Cambridge Univ. Press. London. 1931.

STATE UNIVERSITY OF IOWA, IOWA CITY, IA.

FROM UNDER THE BUSHEL

"N. W. Ayer & Son, Inc., Directory of Newspapers and Periodicals, Philadelphia . . . Dear Mr. Grant . . . Normally, we do not list any periodical that does not have a regular issue. . . However, your publication seems to be quite distinctive and unusual in nature and has important information for its field. Therefore, we are stretching the point and including it in the 1947 Directory. . . Sincerely yours, J. P. H. Johnson, Editor."

Mr. Romeo Mansueti, our Member, made this very handsome illumination for the Herpetologists League. We have used it for two purposes. First as a certificate, sent to those persons appointed Fellows, with this wording: "This is to certify that . . . by virtue of having contributed significantly to the study of Herpetology, was by vote of the Officers of the Herpetologists League, elected a FELLOW. In testimony whereof the President and Secretary have hereunto set their hand and seal of the Herpetologists League this ..... day of ....."

Secondly we have worded it as an informative circular which has been mailed to the libraries and Biol. Depts. of the leading Colleges and Universities of the country. We will be glad to mail some of these circulars to any Member or friend who wishes to use them to spread information about our publication and the League to interested persons or organizations.

We have inaugurated the following CLUB PLAN available to interested persons at an Institution of Learning or members of a society, etc.,where a file of HERPETOLOGICA is available. Such persons may join the League with all privileges of publication and advancement to Fellowship by the payment of one dollar, concurrently with the issuance of a volume.

The Voice of Hyla versicolor in Virginia

By RICHARD L. HOFFMAN

The initial comments on vocal variation in *Hyla v. versicolor* in Maryland by Noble and Hassler (1936, Copeia, pp. 63-64), supplemented recently by those of Walker (1946, *The Amphibians of Ohio,* Pt. 1, pp. 65-66), have prompted compilation of the writer's field notes on the subject into the remarks which follow.

Noble and Hassler noted that the calls of treetoads in Calvert County, Maryland, differed trenchantly from those of various other areas in being harsher and of shorter duration. Farther north along the Chesapeake Bay, local populations of *versicolor* contained diminishing numbers of the harsh voices, until at Baltimore all were of the "typical" mellow variety. Walker presented information of a similar nature, relative to geographic segregation of voice types in Ohio *versicolor*. He has found that the harsh voiced frog occurs almost exclusively in the unglaciated part of the state, in the region adjoining the Ohio River.

During the warmer months of 1945 and 1946, I have heard and collected treetoads in various parts of Virginia, representing a cross-section of the state, complete except for the portion included in the Appalachian Plateau. An interesting disposition of the two voice types has been noted.

The typical, mellow, rather prolonged trill of northern *versicolor* is common to treetoads of the Virginia mountains and Piedmont. It has been noted at localities in Alleghany, Augusta, Bath, Botetourt, Roanoke, and Rockbridge counties in the Valley and Ridge Province; and in Albemarle, Fairfax, Fluvanna, Henrico, and Louisa counties on the Piedmont Plateau.

The harsh, shorter, and more forceful call of the other type appears to be restricted to the Coastal Plain, and to a few areas with coastal affinities. Frogs of this category have been found in the extreme eastern and western portions of southern Virginia. In the southeast, the incidence of this type is not unexpected, inasmuch as Noble and Hassler's localities are in the Coastal Plain of Maryland. It has been heard in Princess Anne, Norfolk, Nansemond, and Isle of Wight counties, and probably ranges throughout the Virginia Coastal Plain. The discovery of the harsh voiced treetoad in southwestern Virginia, however, is of some interest. On May 25, 1946, it was heard and collected in Lee County on the Powell River, approximately 4 miles southeast of Jonesville. The specimens were found

about a muddy pond in a treeless pasture of considerable size. They were quite numerous, and associated with *Bufo w. fowleri* and *Rana clamitans*. In addition to this locality, sound records exist for several situations in Lee, Scott, Washington, and Smythe counties. All of these stations are located in the Tennessee River drainage, and are at comparatively low elevations. The headwaters of the Tennessee River in Virginia have produced, as might be expected, several amphibians and reptiles with lowland affinities, such as *Rana pipiens* and *Amyda spinifera*.

Versicolor heard in some numbers in a swamp in Louisa County, Virginia, on September 21, 1946, produced calls that were roughly intermediate between the two voice types, tending more toward the upland variety. The call was harsh, but more prolonged than those heard in southeastern Virginia near Norfolk. Louisa County is on the Piedmont Plateau, about 15 miles inland from the Fall Line, but the river bottom swamps are much like Coastal Plain habitats. Among certain coastal plants noted at the time were *Pinus taeda, Liquidambar styraciflua,* and *Quercus phellos*.

Neither Noble and Hassler nor Walker have presented any morphological differences between the frogs of the two voice types. It is not considered within the scope of this note to differentiate between the two, but it may be of some interest to point out that in all of the Virginia material seen, the harsh voiced lowland form attains sexual maturity at a much smaller size than does the upland mellow voiced variety. The snout to vent length of sexually mature males of the former group from Nansemond and Lee counties ranges from 34 to 40 mm., averaging 37.2. Similar measurements on the latter kind range from 44 to 51 mm., the average being 47.7. These measurements were made on *versicolor* from Albemarle County on the Piedmont Plateau and from Alleghany County in the Valley and Ridge Province. Overlaps in the length of sexually mature males certainly occur, but the average discrepancy is marked. Noble and Hassler also found the harsh voiced frog to be slightly smaller, but this difference does not appear to be so great in the material seen from more southern states.

The smaller, harsh-voiced frog appears, from the present data, to be distributed in Virginia almost exactly like the narrowmouth toad, *Microhyla c. carolinensis*. Both forms are common in the Coastal Plain and seem to reach their northern limits in southern Maryland; and both occur on the upper Tennessee River drainage. Unfortunately, there is no information on voice segregation in *versicolor* farther south, if such occurs so noticeably there.

CLIFTON FORGE, VIRGINIA

Feeding Notes on Two Small Lizards

By GEORGE F. KNOWLTON

Two days after its capture near Snowville, Utah, a sagebrush swift, *Sceloporus graciosus graciosus* (B.-G.), was placed in a cage with miscellaneous insects and permitted to feed for one hour. Eighteen hours later it was fed (by hand) 10 freshly killed adult beet leafhoppers, *Eutettix tenellus* (Baker). After thirty hours had elapsed from this latter feeding, the lizard was destroyed and its stomach examined. Parts of two beet leafhoppers still were distinguishable, although the soft inner tissues appeared to have been rather completely digested away. Other recognizable material present in the stomach consisted of: a heavily sclerotized weevil, largely intact and but slightly elongated after subjection to 48 hours of digestion in the stomach; elytra of a ladybird beetle, *Hippodamia quinquesignata* Kirby, still were recognizable, as was the flattened body of a lepidopterous caterpillar which appeared to have had its body tissues largely digested away. Fragments of heads, legs and bodies of a few ants, a wild bee and of a few other insects still were present.

The stomach of a second swift, treated exactly as the above, still contained the recognizable tips of the abdomens of three adult beet leafhoppers, several of the harder portions of 1 ladybird beetle, *Hippodamia convergens* Guerin, and the body walls and attached heads of 3 lepidopterous caterpillars, also legs and body fragments of other miscellaneous insects.

On June 4, 1936, several sagebrush swifts each were confined in individual glass battery jars with boxelder bugs, *Leptocoris trivittatus* (Say). One of the swifts ate one adult and two nymphs of this bug in one and one-half hours. A second swift ate 8 nymphs in six hours. The third lizard, confined with 22 boxelder bugs for fourteen hours, ate none of them. Apparently the boxelder bug was much less attractive to the lizard than grasshoppers, ants and a variety of insects collected on Russian thistle in desert and abandoned dry-farm areas.

A brown-shouldered uta, *Uta stansburiana stansburiana* (B.-G.), about two-thirds grown, was watched as it stood in the shade of a sagebrush, on a foothill south-east of Timpie, Utah, on August 28, 1933. A grasshopper, *Hesperotettix viridis* Thomas, jumped from the sagebrush and "landed" approximately 5 inches from the lizard. Instantly the lizard sprang, grasping the grasshopper firmly in its mouth, quickly and vigorously beating its prey back and forth against the ground. The grasshopper was badly damaged before ingestion was attempted by the lizard. This "beating" of the prey against the ground was observed to occur very commonly when large prey, such as a grasshopper or large caterpillar was captured by this lizard species, or by the common sagebrush swift.

An unusual occurrence was observed on August 23, 1932, in a beet leafhopper summer breeding area 6 miles north-west of Delle, Utah. In this instance an adult *Uta s. stansburiana* was found to be approximately 8 inches off the ground, up in a large Russian thistle plant. Upon being disturbed this specimen quickly dodged down and under a large nearby plant. Upon being collected and brought into the laboratory, an examination of its well-filled stomach revealed: 13 adult and 81 nymphal beet leafhoppers, 1 clover leafhopper, 31 adult and 18 nymphal false chinchbugs, 1 pale lygus alfalfa bug, 2 pentatomid bugs, one being a *Thyanta custator* (Fabr.), 2 flies, and numerous insect fragments.

Extensive studies have been made in Utah of the brown shouldered Uta as a predator of the beet leafhopper. Occurring in abundance as it does upon semi-desert range breeding areas of this serious insect pest, its feeding habits are of definite benefit to the growers of sugar-beets, tomatoes, beans, squash, melons and other crops susceptible to the curly-top disease which this insect disseminates. In several instances more than 100 beet leafhoppers have been recognized in individual stomachs of these lizards, collected while feeding beneath heavily infested Russian thistle plants during late September and October, particularly in Tooele County areas of Utah.

The stomach of a *Uta s. stansburiania* collected June 19, 1933, in the foothills south-east of Timpie, Utah, contained 3 adult and 1 nymphal beet leafhopper, 1 coreid bug, 3 false chinchbugs, 3 adult and 2 nymphal big-eyed *Geocoris* bugs, 1 pyrrhocorid, 1 reduviid, 1 mirid, 4 ants and 3 wasps. Another *stansburiana* collected the same day at Flux, also in Tooele County, contained 3 nymphal beet leafhoppers, 4 false chinchbugs, 1 adult and 1 nymphal big-eyed bug, 1 lepidopterous larva and 1 spider. A *stansburiana* collected at Delle among Russian thistle on October 8 held 87 termites in its stomach. One taken August 14, 1933, at 7 miles west of Delle contained 8 adult and 1 nymphal beet leafhoppers, 1 big-eyed bug, 1 big-eyed fly, 1 chloropid fly, 5 ants and 7 spiders.

In studying the insect food of and making observations on the speed of digestion in small insectivorous lizards, it has appeared that small, soft bodied insects generally are passed from the lizard stomach into the intestine sooner than are hard bodied, larger insects. Bodies of weevils, darkling beetles, heads of large ants and similar heavily sclerotized forms have been found still within the stomachs of the above small desert lizards for three or more days after being eaten. Beet leafhopper nymphs fed to *stansburiana* were digested, or had passed from the stomach into the intestine of this lizard, by the end of 12 hours.

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